

## PHOSPHITE ESTER ADDITIVE COMPOSITIONS

This application claims priority from United States provisional patent application serial number 60/273,303 filed March 2, 2001, United States provisional patent application serial number 60/314,181 filed March 16, 2001, and United States provisional patent application serial number 60/315,746 filed August 29, 2001.

### ***Technical Field***

The invention relates generally to improving the performance and reducing the heavy metal content of PVC compounds by the partial or total substitution of conventional mixed metal stabilizers with phosphite esters, or blends thereof, with an effective amount of added zinc.

### ***Background of the Invention***

The PVC industry began with the invention of plasticized polyvinyl chloride ("PVC") by Waldo Semon of the B. F. Goodrich Company in 1933 as an alternative to natural rubber where its non-flammability made it ideal for wire insulation, particularly on naval ships. However, unlike rubber, PVC has a tendency to discolor and is not easy to process well. Stabilization is required to perform two basic functions: (1) prevent discoloration; and (2) absorb hydrogen chloride (HCl) which evolves during process. It is believed that billions of pounds of flexible PVC are employed throughout the world in a wide variety of commercial applications. These include vinyl flooring, wall covering, roofing, pond and pool liners, film, upholstery, apparel, hose, tubing and wire insulation.

In order to successfully process vinyl compounds into finished vinyl articles by extrusion, calendering or molding, it is necessary to incorporate between one and five percent of a heat stabilizer to prevent dehydrohalogenation and discoloration of the polymer during thermal processing. The preferred vinyl heat stabilizers for most flexible PVC applications in the United States are referred to as "Mixed Metal" heat stabilizers. They are complex multi-component chemical admixtures based upon combinations of alkaline earth and heavy metal salts with a variety of antioxidants, HCl absorbers and chelating agents. The most widely used mixed metals are based upon and referred to as Barium-Cadmium, Barium-Cadmium-Zinc, Barium-Zinc and Calcium-Zinc stabilizers. However, mixed metal heat stabilizers suffer from several drawbacks. If the level of zinc is too high, the polymer will char very rapidly. Additionally, barium and cadmium are toxic heavy metals which while they do provide heat stability, their presence adversely affects

clarity, plate out and stain. In order to counteract these negative effects, further additional components were blended into the formulations, making PVC additive formulation and processing a highly unique and specialized art. Clearly, what was needed was an approach which used higher performance phosphites and added back only what was

5 needed.